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May 18, 2010

Becky Blais
Division of Land Resource Regulations
Bureau of Land & Water Quality
Maine Department of Environmental Protection
17 State House Station
Augusta, ME 04333-0017

Subject : Calais LNG: Response Regarding SLOD Section 5 - Noise

Dear Ms. Blais:

This letter is in response to your emails of April 29, 2010 and May 12, 2010 regarding SLODA Section 5 – Noise. You had asked that I describe the difference between Noise Sensitive Areas (NSAs) and "protected locations." Protected locations is a term used in the state's noise rules, while NSA is a term typically used in the FERC context. Your communications on this topic also pointed out that you can only review SLODA Section 5 as it relates to the DEP's current noise regulation, Chapter 375.0, Control of Noise.

In our SLODA application where Calais LNG says "NSA" in the context of SLODA/MEDEP discussions regarding noise standards, it should be read as if it says "protected location." The term "noise sensitive area" is a general term used in the Federal process, whereas "protected location" has a specific definition in the Maine DEP's Site Location of Development noise rules. In the context of this project, all of the NSAs are protected locations, including Ganong and St. Croix Island. Calais LNG included other information on Federal noise parameters in its Site Location application merely for completeness.

I have attached a copy of SLODA Section 5 in which I highlighted the term "NSA" where it should be understood as "protected location." The acronym "NSA" is not highlighted in those parts of Section 5 – Noise that discuss FERC limits. Note that this is the same version of text that we submitted to you on January 27, 2010; the highlights have been added for clarification, but no revisions have been made to the text.

Thank you for requesting clarification; I hope that this explanation has provided what you need to complete your review of SLODA Section 5 – Noise. Please don't hesitate to contact me if you have any additional questions regarding SLODA Section 5 – Noise, or any other section of the SLODA application.

Sincerely,

WOODARD & CURRAN INC.

Thomas R. Eschner
Senior Project Manager

219431.01

cc.: Art Gelber, Calais LNG Project Company, LLC
David Van Slyke, Preti Flaherty

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5. NOISE

This section evaluates the existing sound levels in the Project Area to determine which regulatory sound limit must be met during construction and operation of the Project. Baseline monitoring has been performed as detailed below. Acoustic modeling has been conducted to predict construction and post-construction sound levels and their impact on the surrounding area. The Project as proposed will meet all applicable noise standards.

5.0 PROJECT DESCRIPTION

The Calais LNG Project Company, LLC (Calais LNG) proposes to construct, own, and operate a liquefied natural gas (LNG) receiving, storage and vaporization Terminal and pipeline (Project). The proposed Project consists of: (i) a liquefied natural gas (LNG) receiving, storage and vaporization Facility; (ii) a Marine Terminal for LNG vessels (both the Facility and Marine Terminal to be constructed, owned and operated by Calais LNG); and (iii) a related natural gas send-out pipeline (Send-out Pipeline) (to be constructed, owned and operated by Calais Pipeline Company, LLC (Calais Pipeline), an affiliate of Calais LNG).

The proposed Terminal Site (comprising the Marine Terminal and the Terminal Facilities) will receive LNG from ocean-going vessels at a site near Ford Point on the St. Croix River in the City of Calais, Washington County, Maine (ME). The Project facilities will allow for berthing and off-loading of LNG vessels, storage of LNG in three 160,000 cubic meters (m^3) LNG tanks, as well as vaporization, and delivery of the natural gas to the Send-out Pipeline connecting the Terminal with the interstate pipeline of Maritimes & Northeast Pipeline, L.L.C. (M&NE), for transportation to markets in New England. The Project will be constructed pursuant to authorizations under Sections 3 and 7 of the Natural Gas Act (NGA).

The Terminal Site will be located within the city limits of Calais, on a site approximately six miles southeast of the city's population center and approximately 20.7 miles from the M&NE pipeline. The Site Area comprises approximately 337 acres of land, consisting of two adjoining properties, including intertidal land, with approximately 2,800 feet (ft) of frontage on the St. Croix River, and adjacent submerged lands. The LNG Terminal will be developed on a portion of the approximately 135 acres that lie between U.S. Route 1 and the St. Croix River.

The Terminal Site will include berthing and unloading marine facilities that, based on the proposed nominal maximum throughput of the Facility of 1.0 billion standard cubic feet per day (bscfd), will receive one to two LNG vessels per week ranging in size from 120,000 to 170,000 m^3.

LNG will be transported up the St. Croix River on vessels that will be escorted by tugs as they enter the Head Harbor Passage near East Quoddy, sail around the southern end of Deer Island, and turn north into the Western Passage. The vessels will enter the proposed approach channel in the St. Croix River near Mill Cove, and proceed 7.3 nautical miles (NM) to the Calais LNG Marine Terminal. The transit from the pilot boarding station located about 1.5 NM east of East Quoddy Head to the Calais LNG berth is approximately 23 NM.

Vessels will be moored at a single berth comprising an unloading platform, breasting dolphins, mooring dolphins, and interconnecting walkways. Arrival draft is expected to be less than 40 ft. The river is wide enough and deep enough in the vicinity of the Marine Terminal to provide sufficient maneuvering area for the vessels. The unloading platform will be designed to accommodate both port and starboard unloading. The unloading platform will be equipped with four LNG unloading arms. The unloading platform will also support LNG liquid and vapor piping, utility connections, vehicle access for support and emergency evacuation, fire detection and firefighting equipment, and walkways. Bathymetric information indicates that a Pier terminating less than 1,000 ft from mean low water will provide the necessary depth for vessels at the berth.

The Project's storage facilities comprise three 160,000 m^3 insulated tanks designed to store LNG at a temperature of -260 degrees Fahrenheit (°F). Two tanks will be included in the initial construction period. Timing of construction of the third tank of the same size will be based on considerations such as expanded market requirements and inventory management in support of supply reliability. The tanks will be of full containment design, whereby the LNG is stored in a primary inner container surrounded by a secondary outer container, each independently capable of containing the LNG. The Terminal vaporization equipment will be designed to deliver 1.0 bscfd (1.2 bscfd peak) of natural gas at a send-out pressure of 1850 pounds (lbs) per square inch (psi) to the gas distribution network via a 36-inch diameter Send-out Pipeline.

The proposed Send-out Pipeline will extend approximately 20.7 miles from the proposed Terminal property boundary to an interconnection with the existing M&NE pipeline in Princeton, ME. The Send-out Pipeline route was selected to follow existing energy and transportation rights of way (ROW) to the extent possible, while also minimizing the number of landowners and natural resources affected by the construction and operation of the Send-out Pipeline. The Send-out Pipeline will be a 36-inch continuously welded steel pipe, which will be installed using appropriate engineering and construction techniques to minimize temporary and permanent disturbance within the 50-foot wide permanent Send-out Pipeline corridor and the additional construction corridor.

For the purposes of this SLOD, the discussion of the Send-out Pipeline is presented in two segments: Segment One is that portion of the Send-out Pipeline located on the Terminal Site and as such is considered along with the Terminal Site when evaluating environmental effects. Segment Two of the Send-out Pipeline is that portion of the Send-out Pipeline beginning at the Terminal property boundary and terminating at the meter station located at the Send-out Pipeline interconnect with the M&NE pipeline.

Please refer to Section 1 – Development Description for detailed descriptions, maps, and drawings of this project.

5.1 NOISE REGULATIONS AND GUIDELINES

The following sections describe federal, state, and local noise standards applicable or relevant to the proposed Calais LNG Project. A summary of these noise criteria is presented in Table 5-1.

5.1.1 Federal Energy Regulatory Commission (FERC)

FERC regulations (18 CFR §380.12) require that all new LNG facilities provide a quantitative estimate of the impact of the Project on sound levels at identified noise sensitive areas (NSA) such as schools, hospitals, or residences. FERC stipulates the use of the day-night sound level (Ldn) and limits sound attributable to a Facility to an Ldn of 55 dBA at any NSA. The Ldn is defined as the hourly equivalent sound level (LAeq) averaged over 24 hours (hr) with 10 decibels added to sound levels occurring during nighttime hrs between 10 p.m. and 7 a.m. Since an LNG Terminal often operates continuously, meeting the Ldn limit of 55 dBA requires the hourly LAeq to be 48.6 dBA or less at any NSA during both daytime and nighttime hours.

5.1.2 Maine Department of Environmental Protection (MEDEP)

MEDEP Site Location of Development Regulation Chapter 375.10, *Control of Noise*, establishes quantitative sound limits for new projects in Maine such as the Calais LNG Project. Under this regulation, hourly sound level limits apply at Facility property boundaries and at nearby protected locations. Protected locations are defined as "any location, accessible by foot, on a parcel of land containing a residence or planned residence or approved residential subdivision, house of worship, academic school, college, library…" (MEDEP SLOD Chapter 375.10). Protected locations also include state and national parks, and locally-designated passive recreation areas, such as the Devil's

Head Recreation Area that abuts the Terminal Site to the north. Transient living accommodations such as hunting camps are not considered protected locations.

Operational Sound

As set forth in Chapter 375.10, Section C, *Sound Level Limits*, the hourly equivalent sound level (LAeq) resulting from Facility operations is limited to 75 dBA at any property boundary. Limits at protected locations vary depending on local zoning or surrounding land uses and existing (pre-development) ambient sound levels.

At protected locations within residential or rural zones or where the predominant surrounding land use is residential or undeveloped, the hourly sound level limits for operation of a Facility are 60 dBA daytime (7 a.m. to 7 p.m.) and 50 dBA nighttime (7 p.m. to 7 a.m.). At protected locations within areas zoned for commercial or industrial uses, or where the predominant surrounding land use is commercial or industrial, the hourly sound level limits for routine Facility operation are 70 dBA daytime and 60 dBA nighttime. In cases where the existing ambient sound level at a protected location exceeds these limits by more than five dBA, higher limits may be applied. In addition, where the daytime pre-development ambient hourly sound level at a protected location is equal to or less than 45 dBA and/or the nighttime hourly sound level is equal to or less than 35 dBA (i.e., low ambient levels), the hourly sound level limits for Facility operation are 55 dBA daytime and 45 dBA nighttime.

The nighttime limits for protected locations only apply within 500 ft of sleeping quarters, and do not apply to National Wildlife Refuges or locally-designated passive recreation areas without a camping area. Thus, only the daytime limits apply to the Devil's Head Recreation Area and the Moosehorn National Wildlife Refuge.

The MEDEP regulation also establishes sound level limits for daytime and nighttime construction activity, and tonal and short duration repetitive sounds as discussed below.

Construction Sound

Even though MEDEP regulations (Chapter 375.10) establish daytime construction limits, subsequent legislation (38 M.R.S.A. Section 484) exempted construction activity that occurs between the hours of 7 a.m. and 7 p.m. or daylight hours, whichever is longer. Sound from non-exempt nighttime construction activity is subject to the same nighttime sound level limits as routine operation. All equipment used in construction must comply with applicable federal noise regulations and include environmental noise control devices in proper working condition as originally provided by its manufacturer.

Short Duration Repetitive and Tonal Sounds

When operations produce a short duration repetitive or tonal sound, 5 dBA is added to the observed sound levels of these sounds for determining compliance with specified limits. Short duration repetitive sounds are events, typically less than 10 seconds in duration, that cause the sound level to increase by 6 dBA or more. There is also a maximum sound level (LAmax) limit for certain types of short duration repetitive sounds.

Exemptions

Sounds associated with certain activities are exempt from regulation under MEDEP Chapter 375.10. Except activities associated with the Project may include:

- Registered and inspected vehicles while operating on public ways or which make deliveries or pickups and do not operate on-site for more than 60 minutes at one time;

- Watercraft while underway;
- Major concrete pours that must extend after 7:00 p.m. when started before 3:00 p.m.;
- Safety and protective devices installed in accordance with code requirements;
- Test operations of emergency equipment occurring in the daytime and no more than once per week;
- Emergency maintenance and repairs; and
- Sounds at a protected location where a noise easement has been granted from the landowner.

MEDEP Chapter 375.10, Section B.1 requires consideration of local quantifiable noise standards. Under this provision, when a development is located in a municipality that has a quantifiable noise standard, then the MEDEP applies the local noise standard rather than the MEDEP standard. Further, when sound produced by a Facility is received in another municipality, the quantifiable noise standards of the other municipality must be taken into consideration.

MEDEP noise standards are based on existing ambient sound levels and can be more stringent than FERC requirements. In addition, state noise limits for nighttime periods are usually more stringent than daytime limits. The Project will operate continuously for 24 hrs per day. Consequently, to the extent the state limits apply, sound from the Project will generally be limited by noise standards applicable during nighttime hours.

5.1.3 City of Calais, Maine

The City of Calais Land Use Codes (effective June 1996, Amended in 2005) contain only a qualitative noise standard for Conditional Uses (SLOD Section 7–Wildlife and Fisheries). Paragraph G.5.i Noise reads as follows:

> i. Noise
>
> The proposed land use shall be conducted so that noise generated will not be objectionable due to volume, intermittence, beat, frequency, or shrillness. Detailed plans for the elimination of objectionable noises may be required before site plan approval is granted.

The intent of this section of the Calais zoning code is consistent with both FERC and MEDEP noise limits: to protect surrounding noise sensitive land uses from adverse noise impact. Thus, by complying with the FERC and MEDEP noise regulations, the Project will meet the intent of the noise control standard established by the City of Calais.

5.1.4 National Marine Fisheries Service (NMFS)

The National Marine Fisheries Service (NMFS) has established guidelines (70 Federal Register 1871, January 11, 2005) to protect marine mammals, as required by the Marine Mammal Protection Act (MMPA), the 1994 amendments to MMPA, and the Endangered Species Act (ESA). These guidelines define two levels of potential: Level A harassment with the potential to injure a marine mammal in the wild, and Level B harassment with the potential to disturb a marine mammal in the wild by causing disruption to behavioral patterns such as migration, breeding, feeding, and sheltering. The NMFS threshold for Level A harassment is 180 dB_{rms} re 1 µPa. The NMFS criteria for Level B harassment are 160 dB_{rms} re 1 µPa (impulse noise) and 120 dB_{rms} re 1 µPa (continuous noise).

5.2 EXISTING NOISE LEVELS

The goals of the baseline sound monitoring program were: 1) Establish existing acoustic conditions near the Terminal Site and along the Pipeline Route; and 2) Perform sound monitoring to satisfy the requirements of MEDEP Chapter 375.10 Section H for the purpose of determining which protected locations are in the low ambient category for which lower sound limits apply. Sound levels in the vicinity of the proposed LNG Terminal were monitored for five 24-hr periods (two weekend days and three week days) to determine existing ambient sound levels at NSAs and protected locations in the vicinity of the Terminal Site. A description of the Site and a summary of ambient monitoring results are presented below.

Instrumentation consisted of two Larson-Davis Model 824 Sound Level Meters, which were programmed to continuously measure sound levels and calculate statistics at hourly intervals. A third sound level analyzer, CEL Model 593, was used to perform 20-minute interval measurements on a recurring schedule at several locations near the Terminal Site and along the Pipeline Route.

The sound level meters meet Type 1 (precision) performance requirements of American National Standard Specification for Sound Level Meters, ANSI S1.4-1983. The microphones were fitted with standard windscreens and mounted on tripods at a height of four to five ft above the ground. The sound level meters were calibrated before and after each 24-hr monitoring period using a Larson Davis CAL200 Sound Level Calibrator. In addition, a certified laboratory calibrated all instrumentation within the past 12 months. This methodology complies with Chapter 375.10, Section H.

5.2.1 Noise Monitoring Locations

The Terminal Site is located along U.S. Route 1 in Calais, Maine, approximately six miles southeast of downtown Calais. The Terminal Site is forested land with one access road leading from U.S. Route 1 down to the shore. From its center, the Site generally slopes toward the shoreline. The approximately 129 acre Site will accommodate the LNG storage and send-out facilities, administrative buildings, access roads, and parking areas. Offshore facilities including a pier and unloading platform will also be constructed for unloading LNG vessels. Portions of the Site not used for the Terminal and vaporization operations would be left undeveloped as a buffer.

Based on aerial photography and field surveys, the primary surrounding land use is rural residential development intermixed with areas of undeveloped wooded land and commercial or public land uses. Existing land uses are consistent with zoning districts as described in the City of Calais Land Use Codes. The Site has approximately 2,800 ft of road frontage on U.S. Route 1 and similar lineal shore frontage on the St. Croix River.

Several residential properties are located to the north, south and west of the Site generally along U.S. Route 1. The nearest residences to the Terminal are located along U.S. Route 1, to the south of the Terminal Site. To the west, there is one residence located across from the Terminal Site on the opposite side of U.S. Route 1. To the north there are two residences on the opposite side of U.S. Route 1 over 1,000 ft from the Terminal Site. The Devil's Head Recreation Area lies to the north of the Site, encompassing all of the area between U.S. Route 1 and the shoreline for over half a mile.

On April 25 through May 2, 2008, ambient sound levels were monitored continuously at two locations on and near the Terminal Site, labeled ML-1 and ML-2 in Figures 5-1 and 5-2. (Note that Tuesday, April 29th is excluded from this period due to inclement weather). In addition to the two continuous meters, a third meter was used to make short term sound measurements at seven different locations (locations ML-3 through ML-9). These nine monitoring locations were selected based on aerial imagery and field observations to represent ambient conditions at nearby

NSAs and protected locations. The calculation of Ldn sound levels at locations ML-3 through ML-9 are based on short-term measurements made at various times of day and night. The monitoring locations are as follows:

Monitoring Location Descriptions

ML-1	Long Term Monitoring Location along the south Terminal Site boundary shared with the closest residence to the south. ML-1 was setback 80 ft from U.S. Route 1 to match the setback of the nearby house. ML-1 represents ambient sound levels at protected locations along U.S. Route 1. Correlates to NSAs at 1231 River Road and 1254 River Road.
ML-2	Long Term Monitoring Location along the north Terminal Site boundary shared with the Devil's Head Recreation Area. ML-2 was setback 1000 ft back from U.S. Route 1 and over 1000 ft from the shoreline. ML-2 represents ambient sound levels at protected remote locations.
ML-3	Shoreline of Terminal Site. Represents ambient sound levels at protected locations along the shore.
ML-4	Access road to Terminal Site, setback 25 ft from U.S. Route 1. Represents ambient sound levels at protected locations along U.S. Route 1. Correlates to NSAs at residence at 1254 River Road.
ML-5	Shoreline at Devil's Head Conservation Area. Represent ambient sound levels at protected locations along the shore. Correlates to NSA at Devil's Head River Overlook.
ML-6	Entrance to Devil's Head Conservation Area, setback 35 ft from U.S. Route 1. Represents ambient sound levels at protected locations along U.S. Route 1. Correlates to NSAs at Devil's Head trailhead and parking lot.
ML-7	Planned new pipeline intersection with existing Maritime Northeast Pipeline (M&NP), setback 35 ft from U.S. Route 1. Represents ambient sound levels at protected locations along U.S. Route 1.
ML-8	End of Maple Street in the Village of Woodland (on the planned Pipeline Route). Represents protected locations along the planned Pipeline Route.
ML-9	Intersection of Front Street and Honey Street, next to train tracks and the St. Croix River. Represents protected locations along the planned Pipeline Route near the Moosehorn National Wildlife Refuge, the St. Croix River and where Horizontal Directional Drilling (HDD) may occur.

5.2.2 Existing Sound Levels

5.2.2.1 Terminal Site and Pipeline Route

During the monitoring period (April 25 through May 2), temperatures ranged from 38 to 70 °F. Average wind speed was five mph with occasional gusts reaching up to 10 mph. Monitoring was not performed during winds in excess of 12 mph, or during periods of rainfall. Skies ranged from clear to mostly cloudy and relative humidity varied from 30 percent to 80 percent.

Pre-development sound level readings taken at all nine locations are presented in Table 5-2. The one-hr LAeq is the parameter specified for use by the MEDEP and FERC for establishing pre-development ambient sound levels. Calculated values are the daytime equivalent sound level LAeq (7 a.m. to 10 p.m.), the nighttime equivalent sound level LAeq (10 p.m. to 7 a.m.), and the Ldn levels. The Ldn levels ranged from 44.7 dBA at ML-2 to 66.8 dBA at ML-4. Other readings in Table 5-2 include average daytime and nighttime LAeq for each measurement location. The predominant audible sounds were traffic on U.S. Route 1 at ML-1, ML-4, ML-6, ML-7 and ML-9; a low rumbling noise

from the industrial Terminal in Canada across the St. Croix River at ML-3 and ML-5, and natural sounds (e.g., birds) at all locations.

At ML-1, the Ldn was 56.2 dBA. During MEDEP daytime (7 a.m. to 7 p.m.), hourly LAeq ranged from 50.9 to 58.3 dBA with an average of 53.8 dBA, and nighttime (7 a.m. to 7 p.m.) hourly LAeq ranged from 33.7 to 52.5 dBA with an average of 46.7dBA.

At ML-2, the Ldn was 44.7 dBA. During MEDEP daytime (7 a.m. to 7 p.m.), hourly LAeq ranged from 30.3 to 49.7 dBA with an average of 40.1 dBA, and nighttime (7 a.m. to 7 p.m.) hourly LAeq ranged from 24.7 to 42 dBA with an average of 35.5 dBA. ML-2 is a protected location with low ambient sound levels.

At ML-3, the Ldn was not calculated, as data for this location were only collected for one daytime period. ML-5 is a similar shoreline location with more complete data. The MEDEP daytime (7 a.m. to 7 p.m.), hourly LAeq of this location was 42.7. ML-3 is a protected location with low ambient sound levels.

At ML-4, the Ldn was 66.8 dBA. The MEDEP daytime (7 a.m. to 7 p.m.), hourly LAeq averaged 63.5 dBA, and the nighttime (7 a.m. to 7 p.m.) hourly LAeq average was 58.9 dBA.

At ML-5, the Ldn was 45.9 dBA. The MEDEP daytime (7 a.m. to 7 p.m.), hourly LAeq averaged 41.0 dBA, and the nighttime (7 a.m. to 7 p.m.) hourly LAeq average was 36.5 dBA. ML-5 is a protected location with low ambient sound levels.

At ML-6, the Ldn was 61.1 dBA. The MEDEP daytime (7 a.m. to 7 p.m.), hourly LAeq averaged 62.7 dBA, and the nighttime (7 a.m. to 7 p.m.) hourly LAeq average was 49.8 dBA.

At ML-7, the Ldn was 64.9 dBA. The MEDEP daytime (7 a.m. to 7 p.m.), hourly LAeq averaged 67.8dBA, and the nighttime (7 a.m. to 7 p.m.) hourly LAeq average was 55.0 dBA.

At ML-8, the Ldn was 49.4 dBA. The MEDEP daytime (7 a.m. to 7 p.m.), hourly LAeq averaged 43.3 dBA, and the nighttime (7 a.m. to 7 p.m.) hourly LAeq average was 38.2 dBA. ML-8 is a protected location with low ambient sound levels.

At ML-9, the Ldn was 57.2 dBA. The MEDEP daytime (7 a.m. to 7 p.m.), hourly LAeq averaged 51.0 dBA, and the nighttime (7 a.m. to 7 p.m.) hourly LAeq average was 45.5 dBA.

A summary of existing sound levels is presented in Table 5-2. The FERC and MEDEP noise limits have been determined for the Project Area based on existing ambient sound levels, land uses, and zoning designations. Review of these criteria reveal two protected locations with low ambient sound levels: 1) the portion of the Devil's Head Recreation Area away from U.S. Route 1 north of the Terminal Site; and 2) residential areas in the Village of Woodland along the Preferred Pipeline Route.

5.2.2.2 Underwater

The ambient sound in the sea comes from many sources, natural and man-made, including turbulence in ocean currents, tides, surface waves, cavitations (collapse of air bubbles) in near-surface waves, low-level seismic activity, sea animals, recreational boats, fishing and other commercial vessels, and ocean-going ship traffic. The ambient underwater sound level is highly variable in time and by location, and can depend on the physical characteristics of the area including water depth, ocean bottom topography, and the proximity to shore. A one-knot current can

produce turbulent pressure changes (sound waves) of 116 dB re 1 µPa (Urick 1983). Typical ambient sound levels measured in Nantucket Sound for the Cape Wind Project were 95-115 dB re 1 µPa, and ambient levels estimated for the Northeast Gateway Project off Cape Ann were 103 to 117 dB re 1 µPa. For the North Hoyle (U.K.) Wind Project, ambient sound levels in that coastal area of Wales were measured to be in the range of 100 to 150 dB re 1 µPa (Nedwell 2003). Given the strong currents in the Bay of Fundy, Passamaquoddy Bay and the St. Croix River, it is estimated that ambient sound levels in these bodies of water range from 95 to 150 dB re 1 µPa, depending on wind speeds and sea turbulence conditions (the lower of these two values corresponds to calmer sea conditions).

5.3 NOISE SENSITIVE AREAS

Figure 5-3 shows the closest NSAs to the Terminal Site. The nearest residences to the Calais LNG Terminal are located along U.S. Route 1, to the south of the Site at 1231 River Road (U.S. Route 1) and 1254 River Road. The Devil's Head Recreation Area lies to the north of the Site and the closest NSAs on that land are the trailhead and parking lot on U.S. Route 1 and the end of the walking trail at the river overlook. Figure 5-3 also locates the St. Croix Island National Park and the Ganong Nature Park in New Brunswick. FERC regulations require compliance with the Ldn 55 dBA limit (equivalent to LAeq 48.6 dBA) at these identified NSAs. MEDEP Site Location of Development Regulation Chapter 375.10, *Control of Noise*, limits sound levels at protected locations near the Terminal Site as follows:

- 50 dBA (nighttime limit) for the residences at 1231 and 1254 River Road and other Calais residential areas;
- 55 dBA (daytime limit for protected locations with low ambient levels) at the Devil's Head River Overlook and lands interior to the Devil's Head Recreation Area, St. Croix Island National Park, and Ganong Nature Park; and
- 60 dBA (daytime limit) at the Devil's Head Trailhead on U.S. Route 1.

5.4 NOISE IMPACTS

5.4.1 Operational Noise Impacts

Maximum sound levels were calculated with the Cadna-A acoustic modeling software assuming simultaneous operation of all components of the Calais LNG Terminal (Appendix 5-A). Cadna-A is a sophisticated 3-D model for sound propagation and attenuation based on International Standard ISO 9613 (ISO, 1996). Atmospheric absorption is the process by which sound energy is absorbed by the air and was calculated using ANSI S1.26-1995 (ANSI, 1995). Air absorption of sound assumed standard day conditions and is significant at large distances and at high frequencies. ISO 9613 was used to calculate propagation and attenuation of sound energy by hemispherical divergence with distance, surface and building reflection, and shielding effects by barriers, buildings, and ground topography. Off-site topography was determined using official USGS digital elevation data for the study area. Predicted maximum sound levels are conservative because: 1) The model was instructed to ignore foliage sound absorption; 2) no ground absorption (i.e., 100 percent sound wave reflection) was assumed for the Terminal Site and for the surface of the St. Croix River; and 3) the acoustic model assumes a ground-based temperature inversion, such as may occur on a calm, clear night when sound propagation is favorable.

5.4.1.1 Terminal Site

Using the proposed site plan, sound level predictions for simultaneous LNG vessel offloading and vaporization activities at the Site were made. The Terminal will include berthing and unloading facilities for an LNG vessel ranging in size up to 170,000 m^3 capacity. Onboard pumps will transfer the LNG to two 160,000 m^3 LNG storage tanks. Sound sources included in the acoustic model were the LNG vessel cargo pumps, the LNG vessel engine (operating

during offloading to supply power to the pumps), SCVs, BOG compressors, high-pressure send-out pumps, a gas metering package, instrument air and nitrogen packages, a central heating plant, and related pumps, valves, piping, and heaters. Standard noise mitigation measures will be used in the Facility design. For this analysis, it was assumed that acoustical enclosures would be used for the BOG compressors, SCVs, send-out pumps, gas metering and instrument air packages, and acoustical hoods would be used on the SCV blowers. All above-ground gas valves and piping would have acoustical lagging and emergency generators would be equipped with exhaust silencers and housed in acoustical enclosures.

The following sound sources are exempt from MEDEP Chapter 375.10 noise regulations and were not included in the Cadna-A model: trucks making deliveries to the Site or picking up LNG from the Terminal; watercraft while underway (tugs and LNG vessel); and reliability testing of emergency generators, which will occur in the daytime. A sound analysis of LNG vessel river transit and an LNG vessel docking at the berth are discussed later in this section.

The Facility will have a maximum normal throughput of 1.0 bscfd, and natural gas will leave the Site both through a 36-inch interconnecting pipeline and by LNG vessel truck. Since no pressure valves or compressors are planned off-site for the interconnecting pipeline, no noise impacts from Pipeline operation would occur.

The predicted maximum sound levels from operations are compared to the FERC limits in Table 5-3 and reveal that the Terminal will safely comply with FERC sound limits at all NSAs. Predicted Ldn sound levels at the NSAs are in the range of 0 dBA to 40.6 dBA, as compared to the FERC Ldn 55 dBA limit. Predicted Facility sound levels are substantially less than existing sound levels at the NSAs where existing sound levels were measured (see Table 5-2).

The predicted maximum sound levels from operations are compared to the MEDEP limits in Table 5-4, and decibel contour maps are provided in Figures 5-4 and 5-5. Predicted operational sound levels at the NSAs are all substantially below the MEDEP limits. Figure 5-5 reveals that all predicted sound levels on the interior portions of Devil's Head Recreation Area are well below the MEDEP limit of 55 dBA. The acoustic model results confirm that the Calais LNG Terminal would fully comply with FERC and MEDEP noise limits.

5.4.1.2 Marine Terminal Site

An LNG vessel in transit will produce a maximum pass-by sound level[1] of 60 dBA at 500 ft, 54 dBA at 1,000 ft, and 48 dBA at 2,000 ft distance. The St. Croix River in the stretch leading up to the Terminal Site is at least 5,000 ft wide and LNG vessels will generally be at least 1,000 ft from shore while in transit. Existing ship traffic to and from the Bayside Industrial Park in New Brunswick produces similar sound levels. The sound of marine vessels underway is exempt from MEDEP sound limits.

When an LNG vessel is approaching the Terminal berth, up to four tugs will assist the berthing process, which is expected to occur over a period of approximately 30 minutes. The estimated sound levels[2] during the berthing process, assuming four tugs and the LNG vessel, are presented in Table 5-5. Predicted hourly LAeq sound levels at the nearest NSAs range from 32 to 38 dBA. Watercraft underway are exempt from MEDEP sound limits.

[1] Sound power data from the Bradford Landing LNG Terminal EIS were used to make these calculations.
[2] Sound power data for an LNG vessel and tugs from the Bradford Landing LNG Terminal EIS were used to make these calculations.

5.4.1.3 Underwater Noise Impacts

The loudness of a sound depends on the radiated sound power of the source and the propagation and attenuation characteristics of the medium that the sound energy passes through. For airborne and underwater sound, the standard unit of measurement is the decibel (dB), a logarithmic scale formed by taking 20 times the $\log_{10}$ of a ratio of two pressures: the measured sound pressure divided by a reference sound pressure. Sound in air is referenced to 20 micro-Pascals (µPa), while underwater sound is referenced to 1 µPa. The different reference pressures result in the underwater scale being is shifted 26 dB higher than the air scale. There are also substantial differences in ambient (background) sound levels in air and in the ocean, and in the frequency weighting that is used in the two media. Finally, the hearing threshold for marine mammals is high up on the underwater decibel scale. Thus, one cannot equate dB levels reported for water with those in air.

Underwater sound levels are presented as unweighted (dB) or linear decibels (dBL); in this section underwater sound pressure levels will be reported as dB re 1 µPa. Underwater sound source levels are expressed as a sound pressure level at a distance of 1 meter from an idealized point source, i.e. dB re 1 µPa at 1 m. Underwater sound impacts occur for both impulse noise sources, such as pile driving, and more continuous sources, such as vessel transit. In all cases, the sound pressure level is a root-mean-square (rms) measure for time-integrated exposure. For impulse noise, such as pile driving, the sound pressure level is time-averaged over the duration of the pulse.

A. Underwater Acoustic Modeling Approach

Sound wave propagation and attenuation underwater is a very complex phenomena influenced by gradients of temperature, salinity, currents, sea surface turbulence, and bottom conditions. Research has shown spherical wave spreading, together with seawater absorption, provides a reasonable fit to measured underwater sound levels under a wide variety of conditions. For sound transmission loss in shallow water as opposed to the open sea, empirical data show spherical wave spreading explains measured sound levels near the source, and cylindrical wave spreading occurs at great distances with a transition in between (Urick 1983). For the water depths in the St. Croix River at the Terminal (48 ft Mean Lower Low Water) and along the transit path through Passamaquoddy Bay and the Bay of Fundy (average depths of 150 to 200 ft), spherical wave spreading occurs for distances of up to 6 km from a source, and cylindrical wave spreading occurs at distances beyond 30 km, with a transition for distances in between. For this analysis where distances of 100 m to 10 km are considered, spherical wave spreading is a reasonable model. Seawater sound absorption is generally less than 1 dB/km for frequencies below 10,000 Hertz (Etter 1991), and to be conservative seawater sound absorption was ignored in the underwater sound calculations.

B. Acoustic Modeling Results

Table 5-6 presents underwater sound levels in dB re 1 µPa at a range of distances from 100 m to 10 km for six operating scenarios in which an LNG vessel is in transit either alone, with three tugboats as escort, or with four tugboats as escort, and traveling at 10 or 20 knots.

C. Noise Impacts

While in transit to and from the Terminal, LNG vessels, and their escort tug boats, will emit underwater sound. After pilot boarding occurs in the area of Quoddy Head, LNG vessels will be travel at a variable speed up to 10 knots. For the Northeast Gateway Project, underwater sound levels were measured at distances of 100 and 200 m from a moving LNG vessel, and the resulting sound source level from an LNG vessel in transit at 10 knots is 153 dB re 1 µPa at 1 m (Tech Environmental 2006). Other LNG vessels transit sound levels in the literature are modeled, not

measured values. The sound source level for a tugboat underway is 173 dB re 1 µPa at 1 m (Malme 1989). Transit to the Terminal will only occur under specified tide conditions. Departures will be planned around High Water Slack for Western Passage, so LNG vessel arrival and departure at the pier will not be at Low Water. Docking and undocking will be performed by the escort tugs, and the main engine of the LNG vessel will only be on Dead Slow ahead or astern. Thus, docking and undocking sound levels will not exceed those listed above for the LNG vessel and tug boats in transit.

Acoustic modeling of the operation noise sources (LNG vessel transit, tug boat transit) was done to generate Table 5-7, which presents the distance at which the identified operation source meets the federal NMFS Level A and Level B criteria to prevent harassment of marine mammals. There is very little potential for Level A harassment from Project operation. According to the noise modeling done for Project operation, thrusters (up to 1 m from the vessel) are the only source of noise that exceeds Level A criteria. Thrusters are not anticipated to be used in any normal transit situations, as they are not useful above three knots. Thrusters will only be used during docking, and therefore due to the substantial distance from the Terminal, risks to Mysticetes and Odontocetes from thruster noise are extremely low. Seals in the Terminal area would be exposed to thruster noise, which according to the noise model will exceed Level A criteria (180 dB re 1 µPa) at 1 m from the vessel, and Level B (120 dB re 1 µPa) up to 1,122 m from the vessel (Table 5-7).

There will be episodic sounds from the arrival and departure of LNG vessels and escort tugs, and the associated vessel sound source levels are no higher than those for vessels and other commercial vessels (170-180 dB re 1 µPa) that presently travel through Head Harbour Passage and Western Passage, into Passamaquoddy Bay and then into the St. Croix River. The potential for Level B harassment at the 120 dB re 1 µPa threshold exists for LNG vessel (up to 45 m at 10 knots, and 250 m at 20 knots) and tug boat transit sound (up to 1,000 m at 10 knots for three tugs; Table 5-7). However, these noise levels will be similar to existing marine vessel sound in these water bodies today, and under high wave or tidal flow conditions ambient sound levels will also likely be above 120 dB re 1 µPa.

5.4.2 Construction Noise Impacts

The Project will consist of land-based and marine-based facilities that will be constructed in parallel over a three-year period. Construction of the Send-out Pipeline is primarily land-based but will also rely on special techniques for crossing water bodies, roads, railroads, and utilities. Activities during the construction phase have the potential to temporarily cause noise impacts to the surrounding area. Noise associated with most construction equipment will be intermittent and construction activity close to residences will be limited to daytime or daylight hours. The following describes noise sources and noise mitigation measures planned for use in the construction of the Project.

5.4.2.1 Terminal Site Construction

Marine-based construction of the LNG vessel berth and connecting trestle structure will involve support pile installation, dolphin construction, and decking construction. To minimize noise impacts, piles may be anchored into bedrock using drilled rock sockets. Pile installation will likely involve both drill/socket and hammer-driven methods and will take place from an offshore barge. Other equipment that will be used are mobile cranes, air compressors, and generators. Pile driving methods to be utilized will be determined as part of detailed design. The acoustic analysis presented here covers the impacts regardless of the final decision on pile driving method.

Land-based construction of the LNG Terminal will consist of land-clearing, excavation, grading, foundation, building erection, and equipment installation. Excavation is generally the noisiest activity and involves the use of excavators,

bulldozers, and loaders. In addition, blasting will be required during excavation and will be done in 40-ft by 20-ft trenches with 10-foot lifts.

Sound levels at nearby NSAs from simultaneous operation of the marine- and land-based construction were calculated using a representative mix of construction equipment at both construction areas and assuming simple hemispheric wave-spreading with distance and shielding by terrain features. The predicted sound levels are provided in Table 5-8. Hourly LAeq sound levels at the nearest NSAs are in the range of 40 to 50 dBA. Construction during daylight hours or from 7 a.m. to 7 p.m. is exempt from MEDEP sound limits. As shown in Table 5-8, the combined maximum LAeq sound levels from construction and pile driving activities on the Site will comply with the nighttime MEDEP sound limits at all nearby NSAs. The Ldn sound levels from construction will depend on the hours per day of activity for each piece of equipment. Construction Ldn sound levels will likely be less than 55 dBA at all NSAs. The Ldn sound levels from construction will comply with the FERC 55 dBA limit.

The very brief sound heard from rock blasting is typically 94 dBA at a reference distance of 50 ft. For the closest residences to the construction site, the maximum sound level heard will be 63 dBA (LAmax). Baseline measurements at these NSAs reveal existing LAmax sound levels are in the range of 70 to 80 dBA (day and night) from motor vehicle traffic on U.S. Route 1. Thus, an occasional sound from a rock blast on the Terminal Site will not be unusual or out of character with the existing acoustic environment.

Blasts are designed to fragment rock and to minimize the amount of excess energy released when the explosives are detonated. This is achieved through the use of sequential timers. A rock blast will consist of several separate detonations spaced eight milliseconds apart; each detonation is called a delay. When an explosive is detonated, the energy expands outward in the rock as a wave front. The wave front from the detonation travels a very short distance before the next detonation occurs and creates a second wave front. The blast is designed so the blast energy from the individual delays destructively interfere with each other, matching wave peaks and troughs. This allows an area of rock to be fractured and yet minimize the amount of blast energy transmitted to the surrounding area.

Blasting required for excavation of the Site will be done in 40’ x 20’ trenches with 10’ lifts. Blast drill holes are typically drilled on a 10’ x 10’ pattern, with each hole holding the explosive for a single delay. The charge for each delay is likely to be less than 100 lbs. The actual charge will be established to ensure compliance with the U.S. Office of Surface Mining Reclamation and Enforcement guidelines for noise and vibration. The very brief sound heard from a rock blast used in construction is typically 94 dBA at a reference distance of 50 ft.

Civil earthworks, including blasting, will occur during the early phases of the construction schedule. Blasting will be used to bring the grade down to the planned base elevations of 62 ft MSL at the tanks and 125 ft MSL in the process equipment area. The three general areas are referred to in this analysis as North (the northern end of the tank farm), South (the southern end of the tank farm), and West (the process equipment area). Blasting will not be done in or near the water. The closest blasting location is estimated to be over 200 ft from the mean high water mark.

Acoustic modeling was done with the Cadna-A model to predict the maximum blast sound levels from the three blast areas at the nearest NSAs, which are at the property line of the Devil’s Head Recreation Area and the two residences south of the Site at 1231 and 1254 River Road. From the North blast area, the Devil’s Head property line is 540 ft to the northwest, and the closest residence is 1231 River Road located 2,770 ft to the south-southwest. From the South blast area, the Devil’s Head property line is 1,440 ft to the northwest, and the closest residence is 1231 River Road located 1,775 ft to the southwest. From the West blast area, the Devil’s Head property line is 675 ft to the northwest, and the closest residence is 1254 River Road located 2,015 ft to the south.

The maximum (LAmax) sound level predicted by the Cadna-A model from the North, South and West blast areas at the Devil's Head property line will be 69.6, 60.6, and 65.4 dBA, respectively. The maximum (LAmax) sound level predicted by the Cadna-A model from the North, South and West blast areas at the nearest residence on River Road (listed above) will be 48.3, 48.3, and 51.6 dBA, respectively. Baseline measurements at these NSAs reveal existing LAmax sound levels are in the range of 70 to 80 dBA (day and night) from motor vehicle traffic on U.S. Route 1. Thus, an occasional sound from a rock blast on the Terminal Site will not be unusual or out of character with the existing acoustic environment.

Predicted in-air noise impacts at all identified NSAs caused by support pile installation are listed in Table 5-8. Predicted LAeq sound levels are in the range of 23 to 46 dBA at the NSAs. Combined impacts pile driving and other construction activities will produce LAeq sound levels in the range of 40 to 50 dBA at the NSAs. Since no construction activity will run for 24 hours without interruption, construction Ldn sound levels will comply with the FERC 55 dBA limit at all NSAs.

The acoustic impacts of possible landside pile driving on the nearby St. Croix River were studied, and using data from pile driving at other sites (Dowding 2000), the maximum peak particle velocity in the ground at the shoreline was estimated to be 5.0×10^{-5} m/sec. Multiplying this ground vibration by the acoustic impedance of water of 1.5×10^{6} Pa-s/m (Selfridge 1985) yields a maximum incident pressure of 7.5×10^{7} µPa. Only a portion of the vibration energy actually will be transferred into the water due to impedance mismatch between the earth and the water. The physics of the situation is such that the transmitted pressure is calculated to be no more than 22 percent of the incident pressure, or 1.7×10^{7} µPa. Converted to decibels, landside pile driving produces an underwater sound source of 145 dB re 1 µPa at 1 m.

Underwater acoustic modeling of possible landside pile driving was done to generate Table 5-9, which presents the distance at which this construction activity meets the federal NMFS Level A and Level B criteria to prevent harassment of marine mammals. There is no potential for Level A or Level B harassment from landside pile driving. Underwater sound levels 20 meters from shore will be less than 119 dB re 1 µPa, and beyond this short distance any sound from landside pile driving will fall below the ambient sound levels in the St. Croix River.

Shallow water measurements of sound from rock drilling support a source level of 167 dB re 1 µPa at 1 m that serves as a reasonable estimate for the drilling of rock sockets at the Project Terminal (Nedwell 2004). The sound source level for an equipment-barge being moved by a tug boat at speeds up to 10 mph has been measured to be in the range of 162-171 dB re 1 µPa at 1 m (Malme 1989 and 2001); a sound source level of 171 dB re 1 µPa at 1 m was used to represent support and construction vessels. The operation of thrusters to dynamically position a vessel may add 5-10 dB, and thruster noise as a sound source was assumed to be 181 dB re 1 µPa at 1 m.

The Project anticipates using support piles of 1 to 2 m diameter and a typical hammer blow energy of 300 kJ. The water depth in the St. Croix River at the Terminal varies between 48 and 60 ft. The sound pressure level from pile driving depends on the hammer blow energy and pile diameter. Studies from two near-shore pile installations provide sound measurements for similar sized piles. As part of the replacement of the east span of the San Francisco-Oakland Bay Bridge, 2.6 m diameter piles were driven and underwater sound measurements were taken at three locations. The average measured sound source level, adjusted to hammer blow energy of 300 kJ, was 222 dB_{rms} re 1 µPa at 1 m (Reyff 2003). Modifications to the Port MacKenzie Dock, Cook Inlet, Alaska, provided the opportunity to collect underwater measurements of pile driving sounds for 0.9 m diameter piles using a hammer blow energy of 223 kJ. The reported sound source level was 223 dB_{rms} re 1 µPa at 1 m (Blackwell 2005). This study uses the Blackwell sound source value for pile driving, adjusted for the attenuation of an air-bubble curtain.

A bubble curtain is a noise mitigation method that surrounds the pile with small air bubbles, which absorb some of the impulse sound energy radiating outward from the pile. The bubble curtain or jacket is produced by an air compressor that pushes air out through a sheathing that surrounds the pile, covering 100 percent of the pile surface over the full depth of the water column surrounding the pile. The project replacing a portion of the San Francisco-Oakland Bay Bridge measured the effectiveness of a bubble curtain to reduce impulse sound levels as more than 10 dB (Reyff 2003). With a bubble curtain proposed as mitigation for this Project, the resulting sound source level for mitigated pile driving is 213 dB_{rms} re 1 µPa at 1 m.

Acoustic modeling of the construction noise sources (pile driving with mitigation, rock drilling, tug and barge transit, and thruster use for positioning construction vessels) was done to generate data shown Table 5-10 and 5-11, which present the distance at which the identified construction activity meets the federal NMFS Level A and Level B criteria to prevent harassment of marine mammals. Construction noise impacts underwater will be temporary and unavoidable. Construction activities as modeled would exceed Level A criteria for pile driving up to 45 m, and Level B criteria up to 447 m from the source, and Level B criteria for rock drilling up to 224 m from the source for rock drilling (Table 5-10). This distance assumes the use of a bubble curtain to reduce impulse noise. To ensure that marine mammals do not venture close to the pile driving activity, two additional mitigation measures will be used: soft-start procedures and Acoustic Harassment Devices (AHD) devices, which generally create an avoidance response over a radius of 500 m. The other construction noise sources (rock drilling, tug and barge transit, use of thrusters) have sound source levels that are in the same range as those for vessels and other commercial vessels (170-180 dB re 1 µPa at 1 m) that presently travel on the St. Croix River. Thus, while the potential for Level B harassment (at the 120 dB re 1 µPa threshold) exists as shown in Tables 5-10 and 5-11, these construction sound sources are similar to existing marine vessel sound sources in the River today, and under high wave or tidal flow conditions ambient sound levels in the River will also likely be above 120 dB re 1 µPa.

5.4.2.2 Pipeline Construction

The Calais LNG Pipeline will be constructed using standard pipeline construction techniques and ROW restoration methods, including trenching, blasting, drilling, and road boring. Construction equipment includes backhoes, bulldozers, pipe-bending machines, and welding. Typical pipeline construction equipment produces sound levels (LAmax) of 80 to 85 dBA at 50 ft and is no louder than typical utility construction in roadways. The Pipeline Route is not densely populated and has been selected to avoid most residences, though it does follow the U.S. Route 1 corridor for portions of its length. Pipeline construction near any one residence will be brief in duration and no nighttime construction will occur near residences. Calais LNG will consult with landowners regarding specifics of the Pipeline Route and construction times to avoid noise impacts in residential areas.

Horizontal directional drilling (HDD) will be required for a section of the pipeline route, parallel to and north of the railroad tracks, and outside the Moosehorn National Wildlife Refuge boundary. The West end of the HDD section will be in Baring Pit, and the nearest NSAs are the Refuge boundary 1,645 ft to the east and a residence along Route 1, 1,460 ft to the southeast. The East end of the HDD section will be in Calais, and the nearest NSA is the Refuge boundary 849 ft to the south. Equipment planned for use at HDD sites includes a drill rig, crane, mud pump and a generator. Based on measurements of HDD activity at similar sites, the typical sound level produced from all equipment is LAmax 89 dBA at a reference distance of 50 ft, which is equivalent to the pass-by sound from a truck on a roadway. As no equipment operates continuously at maximum power, acoustic maximum and usage factors are used to convert maximum sound levels to equivalent sound levels. The HDD activity LAeq sound level is 79 dBA at a reference distance of 50 ft HDD pipeline construction could extend up to three months during the overall construction period, and the drilling equipment may operate portions of both the day and night.

Acoustic modeling was used to predict the LAeq sound levels at the nearest NSAs accounting for sound wave spreading with distance and soft ground sound absorption. FERC regulations require compliance with the Ldn 55 dBA limit, equivalent to LAeq 48.6 dBA for continuous activity, at the identified NSAs. MEDEP Site Location of Development Regulation Chapter 375.10, Control of Noise, limits sound levels as follows: LAeq 60/50 dBA at the residence near the West borehole (daytime/nighttime limit) and LAeq 55 dBA at the Refuge (daytime limit for protected locations with low ambient levels; nighttime sound limits do not apply to National Wildlife Refuges).

The predicted LAeq sound levels are listed in Table 5-8. HDD construction activity during the daytime period is exempt from MEDEP limits. The results in Table 5-12 reveal full compliance with the MEDEP sound limits for nighttime operations. The Ldn sound levels, assuming construction day and night, are listed in Table 5-13 and reveal full compliance with the FERC 55 dBA limit at both ends of the HDD section.

5.5 NOISE MITIGATION

Predicted maximum sound levels from Terminal operation comply with all FERC and MEDEP sound limits. To help ensure compliance, the Facility design includes acoustical enclosures and hoods for major components and acoustical lagging of above-ground pipelines and valves. The Site provides a substantial buffer between the Terminal and nearby NSAs. To minimize construction noise impacts, plant equipment will be assembled off-site and brought in by barge to eliminate many truck trips to the Site. Pile installation for the marine-based Facility will use a drill and socket method instead of pile hammering where feasible. Pipeline construction will be scheduled to avoid noise impacts in residential areas and any nighttime pipe construction work will use acoustical enclosures to ensure compliance with MEDEP sound level limits.

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SLOD Table 5-1: Applicable Noise Standards

Summary of Applicable Sound Requirements by Agency, Criterion and Associated Metric			
Agency	**Decibel Limit**	**Metric**	**Measurement Location/Condition**
FERC	55 dB (A) 48.6 dB (A)	24-Hour Ldn Hourly LAeq	Identified nearby NSA Identified nearby NSA
MEDEP	75 dB (A) 60 dB (A)* 50 dB (A)* 55 dB (A)* 45 dB (A)*	Hourly LAeq Daytime Hourly LAeq Nighttime Hourly LAeq Daytime Hourly LAeq Nighttime Hourly LAeq	Facility property line Protected location* Protected location* Protected location* with low ambient levels Protected location* with low ambient levels
City of Calais	None	Qualitative	Comply with Federal and State requirements
* The nighttime limits at protected locations only apply within 500 ft of sleeping quarters. At distances greater than 500 ft, or where no sleeping quarters exist (e.g., school), daytime limits apply during all operating hours. The nighttime limits do not apply to National Wildlife Refuges or locally-designated passive recreation areas without a camping area. Thus, only the daytime limits apply to the Devil's Head Recreation Area and the Moosehorn National Wildlife Refuge.			

SLOD Table 5-2: Existing Sound Levels and Regulatory Limits (dBA)

Monitoring Position	Existing Ldn	Existing Average Day LAeq (7am to 7pm)	Existing Average Night LAeq (7pm to 7am)	Low Ambient Levels Per MEDEP Ch. 375.10?
ML-1	56.2	53.8	46.7	No
ML-2	44.7	40.1	35.5	Yes
ML-3	(1)	42.7	(1)	Yes
ML-4	66.8	63.5	58.9	No
ML-5	45.9	41.0	36.5	Yes
ML-6	61.1	62.7	49.8	No
ML-7	64.9	67.8	55.0	No
ML-8	49.4	43.3	38.2	Yes
ML-9	57.2	51.0	45.5	No
(1) Nighttime measurements were not made at this location.				

SLOD Table 5-3: Maximum Operational Sound Levels and Comparison to FERC Limits

NSA	Direction and Distance (ft) from BOG Compressors	LAeq (dBA)	Ldn (dBA)	FERC Ldn Limit (dBA)
Residence at 1254 River Road	S at 1,950	35.6	42.0	55.0
Residence at 1231 River Road	SSW at 1,800	40.6	47.0	55.0
Devil's Head Trailhead	NW at 4,500	28.4	34.8	55.0
Devil's Head River Overlook	NNW at 4,800	20.7	27.1	55.0
St. Croix Island National Park	SE at 9,000	0	<10	55.0
Ganong Nature Park, NB	N at 9,150	0	<10	55.0

SLOD Table 5-4: Maximum Operational Sound Levels and Comparison to MEDEP Limits

NSA	Direction and Distance (ft) from BOG Compressors	LAeq (dBA)	MEDEP Limits (dBA)	
			Daytime	Nighttime
Residence at 1254 River Road	S at 1,950	35.6	60	50
Residence at 1231 River Road	SSW at 1,800	40.6	60	50
Devil's Head Trailhead	NW at 4,500	28.4	60	60
Devil's Head River Overlook	NNW at 4,800	20.7	55	55
St. Croix Island National Park	E at 9,000	0	55	55
Ganong Nature Park, NB	N at 9,150	0	55	55

SLOD Table 5-5: Estimated Sound Levels During LNG Vessel Berthing (dBA)

NSA	Direction and Distance (ft) from LNG Berth	Sound Level During Berthing	
		30-Minute Cycle	Hourly LAeq
Residence at 1254 River Road	SW at 4,200	26	23
Residence at 1231 River Road	SW at 4,280	24	21
Devil's Head Trailhead	WNW at 6,000	21	18
Devil's Head River Overlook	NW at 4,350	30	27
St. Croix Island National Park	SE at 8,700	0	0
Ganong Nature Park, NB	NNW at 8,100	0	0

SLOD Table 5-6: Underwater Acoustic Modeling of an LNG Vessels in Transit with Tugboats

Distance (meters)	Underwater Sound Level dB re 1 µPa					
	LNG Vessel 10 knots	LNG Vessel 10 knots plus 3 tugboats	LNG Vessel 10 knots plus 4 tugboats	LNG Vessel 20 knots	LNG Vessel 20 knots plus 3 tugboats	LNG Vessel 20 knots plus 4 tugboats
100	113.0	137.8	139.0	126.0	138.1	139.2
150	109.5	134.3	135.5	122.5	134.6	135.7
200	107.0	131.8	133.0	120.0	132.1	133.2
250	105.0	129.8	131.0	118.0	130.1	131.2
500	99.0	123.8	125.0	112.0	124.1	125.2
750	95.5	120.3	121.5	108.5	120.6	121.7
1,000	93.0	117.8	119.0	106.0	118.1	119.2
1,250	91.1	115.9	117.1	104.1	116.2	117.3
1,500	89.5	114.3	115.5	102.5	114.6	115.7
1,750	88.1	112.9	114.1	101.1	113.2	114.3
2,000	87.0	111.8	113.0	100.0	112.1	113.2
2,250	86.0	110.8	112.0	99.0	111.1	112.2
2,500	85.0	109.8	111.0	98.0	110.1	111.2
2,750	84.2	109.0	110.2	97.2	109.3	110.4
3,000	83.5	108.3	109.5	96.5	108.6	109.7
3,250	82.8	107.6	108.8	95.8	107.9	109.0
3,500	82.1	106.9	108.1	95.1	107.2	108.3
3,750	81.5	106.3	107.5	94.5	106.6	107.7
4,000	81.0	105.8	107.0	94.0	106.1	107.2
4,250	80.4	105.2	106.4	93.4	105.5	106.6
4,500	79.9	104.7	105.9	92.9	105.0	106.1
4,750	79.5	104.3	105.5	92.5	104.6	105.7
5,000	79.0	103.8	105.0	92.0	104.1	105.2
5,250	78.6	103.4	104.6	91.6	103.7	104.8
5,500	78.2	103.0	104.2	91.2	103.3	104.4
5,750	77.8	102.6	103.8	90.8	102.9	104.0
6,000	77.4	102.2	103.4	90.4	102.5	103.6
6,250	77.1	101.9	103.1	90.1	102.2	103.3
6,500	76.7	101.5	102.7	89.7	101.8	102.9
6,750	76.4	101.2	102.4	89.4	101.5	102.6
7,000	76.1	100.9	102.1	89.1	101.2	102.3
7,250	75.8	100.6	101.8	88.8	100.9	102.0
7,500	75.5	100.3	101.5	88.5	100.6	101.7
7,750	75.2	100.0	101.2	88.2	100.3	101.4
8,000	74.9	99.7	100.9	87.9	100.0	101.1
8,250	74.7	99.5	100.7	87.7	99.8	100.9
8,500	74.4	99.2	100.4	87.4	99.5	100.6

Distance (meters)	Underwater Sound Level dB re 1 µPa					
	LNG Vessel 10 knots	LNG Vessel 10 knots plus 3 tugboats	LNG Vessel 10 knots plus 4 tugboats	LNG Vessel 20 knots	LNG Vessel 20 knots plus 3 tugboats	LNG Vessel 20 knots plus 4 tugboats
8,750	74.2	99.0	100.2	87.2	99.3	100.4
9,000	73.9	98.7	99.9	86.9	99.0	100.1
9,250	73.7	98.5	99.7	86.7	98.8	99.9
9,500	73.4	98.2	99.4	86.4	98.5	99.6
9,750	73.2	98.0	99.2	86.2	98.3	99.4
10,000	73.0	97.8	99.0	86.0	98.1	99.2

SLOD Table 5-7: Minimum Distances at which Sound Levels from LNG and Tug Boat Transit Meet the NMFS Sound Level Guidelines for Marine Mammals

NMFS Guideline	Type of Sound	Criteria Level (dB_{rms} re 1 µPa)	Minimum distance at which criteria are met (meters)	
			LNG Transit	Tug
NMFS Level A	All, dB_{rms}	180	0	0
NMFS Level B	Impulse, dB_{rms}	160	N.A.	N.A.
NMFS Level B	Continuous, dB_{rms}	120	45	447

SLOD Table 5-8: Estimated Sound Levels During LNG Terminal Construction (dBA)

NSA	Direction and Distance (ft) from BOG Compressors (LNG Berth)	Excavation Activity Hourly LAeq BOG Compressors	Pile Driving LNG Berth		Combined Impacts Hourly LAeq
			LAmax	LAeq	
Residence at 1254 River Road	S at 1,950 (SW at 4,200)	37	56	46	47
Residence at 1231 River Road	SSW at 1,800 (SW at 4,280)	38	56	46	47
Devil's Head Trailhead	NW at 4,500 (WNW at 6,000)	50	33	23	50
Devil's Head River Overlook	NNW at 4,800 (NW at 4,350)	29	56	46	46
St. Croix Island National Park	SE at 9,000 (SE at 8,700)	44	50	40	45
Ganong Nature Park, NB	N at 9,150 (NNW at 8,100)	24	50	40	40

SLOD Table 5-9: Minimum Distances at which Sound Levels from Landside Pile Driving Meet the NMFS Sound Level Guidelines for Marine Mammals

NMFS Guideline	Type of Sound	Criteria Level (dB_{rms} re 1 µPa)	Minimum distance at which criteria are met (meters)
			Landside Pile Driving
NMFS Level A	All, dB_{rms}	180	0
NMFS Level B	Impulse, dB_{rms}	160	0
NMFS Level B	Continuous, dB_{rms}	120	N.A.

SLOD Table 5-10: Minimum Distances at which Sound Levels from Mitigated Pile Driving and Rock Socket Drilling Meet the NMFS Sound Level Guidelines for Marine Mammals

NMFS Guideline	Type of Sound	Criteria Level (dB_{rms} re 1 µPa)	Minimum distance at which criteria are met (meters)	
			Pile Driving	Rock Drilling
NMFS Level A	All, dB_{rms}	180	45	0
NMFS Level B	Impulse, dB_{rms}	160	447	N.A.
NMFS Level B	Continuous, dB_{rms}	120	N.A.	224

SLOD Table 5-11: Minimum Distances at which Sound Levels from Transit of an Equipment Barge and Tug Boat, and Positioning of Construction Vessels, Meet the NMFS Sound Level Guidelines for Marine Mammals

NMFS Guideline	Type of Sound	Criteria Level (dB_{rms} re 1 µPa)	Minimum distance at which criteria are met (meters)	
			Tug and Barge Transit	Thrusters
NMFS Level A	All, dB_{rms}	180	0	1
NMFS Level B	Impulse, dB_{rms}	160	N.A.	N.A.
NMFS Level B	Continuous, dB_{rms}	120	355	1122

SLOD Table 5-12: Maximum HDD Construction Sound Levels and Comparison to MEDEP Limits

HDD Borehole - NSA	Direction and Distance (ft) to NSA from HDD Activity	LAeq (dBA)	MEDEP Limits (dBA)	
			Daytime	Nighttime
West - Residence	SE at 1,460	27.4	60	50
West - MNWR	E at 1,645	26.1	55	55
East - MNWR	S at 849	33.3	55	55

SLOD Table 5-13: Maximum HDD Construction Sound Levels and Comparison to FERC Limits

NSA	Direction and Distance (ft) to NSA from HDD Activity	LAeq (dBA)	Ldn (dBA)	FERC Ldn Limit (dBA)
West – Residence	SE at 1,460	27.4	33.8	55.0
West – MNWR	E at 1,645	26.1	32.4	55.0
East - MNWR	S at 849	33.3	39.7	55.0